

## **DETAILED ACTION**

### **Claim Rejections - 35 USC § 103**

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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4. Claims 1, 4-9, 13, 14 and 16-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iwanaga et al. (EP 1170250) in view of Filippi (EP 1153653).

In regard to claims 1 and 7, Iwanaga teaches a method of producing chlorine comprising the step of oxidizing hydrogen chloride with a gas containing oxygen in the presence of a catalyst. The reaction is carried out in at least two reaction zones that contain a catalyst packed layer, with the temperature of at least one of the reaction chambers being controlled by a heat exchange system to prevent the formation of excessive hot-spots in the catalyst layer (abstract). Iwanaga fails to teach the use of a reactor that includes heat-exchange plates arranged longitudinally in the reactor, the gaps between which are filled with the catalyst.

Filippi teaches a reactor for exothermic reactions that contains heat-exchange plates. The plates are arranged in the longitudinal direction of the reactor, and are embedded within a catalytic layer supported by the shell of the reactor (paragraph 1). A heat exchange fluid flows within ducts that are provided within the heat exchange plates (paragraph 22).

It would have been obvious to one skilled in the art at the time of the invention to utilize the reactor taught by Filippi in the process taught by Iwanaga. Such a modification would have been motivated by the teaching in Filippi that the reactor is suitable for controlling the temperature of exothermic reactions, and the teaching in Iwanaga that the oxidation of hydrogen chloride is exothermic and that the creation of hot spots in the catalytic layer of the reactor should be minimized. Further, Filippi teaches that the reactor design utilizing heat exchange plates overcomes major

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disadvantages of prior art reactors that utilized a shell-tube heat exchange design (paragraphs 15-21).

In regard to claim 4, Filippi teaches that the heat exchange plates may be arranged parallel to each other (figure 1).

In regard to claim 5, Filippi teaches that the heat exchange plates may be arranged radially, leaving a central space and a peripheral channel free in the reactor (figure 4). The feed gases flow in a radial manner between the heat exchange plates (figures 4 and 6).

In regard to claims 6 and 20, while Filippi does not expressly teach that the heat exchange plates have a radial extension of 0.1-0.95 of the reactor radius, it would have been obvious to one skilled in the art at the time of the invention that the plates extend for at least 0.3 of the reactor radius (figures 4 and 6).

In regard to claim 8, Filippi teaches a heat exchange element that is made up of multiple rectangular plates. The plates are arranged to be parallel to one another, leaving a gap between the individual plates (figures 2, 3 and 5).

In regard to claim 9, Filippi teaches that multiple heat exchange elements are utilized in the reactor module. The heat exchange modules utilized are identical in nature (figure 3).

In regard to claim 13, Iwanaga teaches that the two reaction zones contain fixed bed catalysts that have different activities (paragraph 17).

In regard to claim 14, Iwanaga teaches that the diameter of the catalyst particles is preferably 0.1-10 mm (paragraph 29). The use of alumina catalyst particles with a diameter of 2 mm is taught (example 2).

In regard to claim 16, Iwanaga teaches that the superficial linear velocity of the gas in a column is preferably 0.2-5 m/s, and that if the linear velocity becomes too high the pressure loss in the packed catalyst zone may increase to undesirable levels (paragraph 39).

In regard to claim 17, Filippi teaches that the heat exchange plates are produced in such a manner that the ducts carrying the heat exchange fluid are always arranged substantially parallel to the gaseous flow. While Filippi does not teach that the heat exchange fluid flows in the same direction as the gaseous mixture, it would have been obvious to one skilled in the art at the time of the invention to utilize such a circulation. This would have been motivated by the teaching in Filippi that the flow of the heat exchange fluid is limited to directions parallel to the gaseous flow within the reactor.

In regard to claim 18, Iwanaga teaches that the reaction temperature is preferably from 200-380°C (paragraph 37), but fails to teach that an inert gas is passed through the reactor at temperatures below 150°C.

It would have been obvious to one skilled in the art at the time of the invention to only supply an inert gas to the reactor when the temperature is less than 150°C, such as at start-up and shutdown. This modification would have been motivated by the teaching in Iwanaga that the performance of the process deteriorates below 200°C, and the knowledge in the art that an inert gas would not damage the reactor.

In regard to claim 19, Filippi teaches that the gases flow in a radial manner between the heat exchange plates (figures 4 and 6).

5. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Iwanaga and Filippi as applied to claim 1 above, and further in view of Hoos et al. (US 4922042).

In regard to claim 2, Iwanaga and Filippi fail to teach that the product gas stream is utilized to chlorinate ethylene, forming 1,2-dichloroethane.

Hoos teaches a process for the production of 1,2-dichloroethane that comprises the reaction of chlorine and ethylene.

It would have been obvious to one skilled in the art at the time of the invention to utilize the chlorine produced by the process obviated by Iwanaga and Filippi. Such a modification would have been motivated by the teaching in Hoos that chlorine may be used to chlorinate ethylene and thereby produce 1,2-dichloroethane and the knowledge that the process obviated by Iwanaga and Filippi would produce chlorine.

6. Claims 3 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iwanaga and Filippi as applied to claim 1 above, and further in view of Kuhn et al. (US 4329527).

In regard to claim 3, Iwanaga and Filippi fail to teach that ethylene may be added to the reactor to produce 1,2-dichloroethane as a desired product of the reaction.

Kuhn teaches that ethylene, chlorine, hydrogen chloride and oxygen may be combined in a reaction zone containing surfaces to be heated and cooled to produce 1,2-dichloroethane (abstract).

It would have been obvious to one skilled in the art at the time of the invention that ethylene could be added to the reactor in the process obviated by Iwanaga and Filippi to produce 1,2-dichloroethane. Such a modification would have been motivated by the teaching in Kuhn that ethylene, chlorine, hydrogen chloride and oxygen may be combined in a reaction zone containing surfaces that are heated and cooled to produce 1,2-dichloroethane. As the process obviated by Iwanaga and Filippi already contains chlorine, hydrogen chloride and oxygen in a reaction zone containing surfaces that are heated and cooled, the addition of ethylene would result in the production of 1,2-dichloroethane as taught by Kuhn. This would allow the system obviated by Iwanaga and Filippi to have greater industrial applicability, as it could then be used to produce chlorine and 1,2-dichloroethane.

In regard to claim 12, Kuhn teaches that an inert gas may be included in the gas stream that is supplied to the reactor (abstract).

7. Claims 10 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iwanaga and Filippi as applied to claims 1 and 9 above, and further in view of Smith (US 3807963).

In regard to claim 10, Iwanaga and Filippi are silent as to the number of heat exchange modules present in the reactor.

Smith teaches a reactor for use in endothermic and exothermic reactions that contains heat exchange modules for the purpose of establishing isothermal conditions in the reaction zone. Smith teaches that the number of heat exchange elements

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present in the reactor is dependent on the type of reaction and the conditions to be employed (column 3, lines 1-5).

It would have been obvious to one skilled in the art at the time of the invention to utilize 4, 7, 10 or 14 heat exchange elements in the reactor taught by Filippi. Such a modification would have been motivated by the teaching in Smith that the selection of the appropriate number of heat exchange elements is within the skill of one in the art (column 3, lines 1-5).

In regard to claim 15, Iwanaga teaches that the catalyst particle size is a critical consideration in the design of the reactor. Specifically, when the particle size is considered with respect to the flow properties of the reactor it is important to ensure that the particle size will not result in too great a pressure loss in the catalyst packed layer (paragraph 41). Iwanaga fails to teach a gap between the heat exchange plates or a ratio of the size of the gap and the particle size in the range required by the claims.

Smith teaches that the arrangement of the interior of the reactor may vary based on the type of reaction and the reaction conditions that are required.

It would have been obvious to one skilled in the art to utilize a gap between heat exchange elements and a ratio of the gap to the particle size of the catalyst within the ranges required by the claims. Such a modification would have been motivated by the teaching in Iwanaga that particle size of the catalyst is critical to the flow properties of the reactor, and the teaching in Smith that the placement of the heat exchange plates within the reactor is within the skill of one in the art.

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8. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Iwanaga and Filippi as applied to claim 1 above, and further in view of Stowell (US 3911843) and Grau (US 5391853).

In regard to claim 11, Filippi teaches that the edges of the heat exchange plates are welded, but fails to teach that the welding is a rolled seam process.

Stowell teaches a method of producing a heat exchange plate, in which the plates are joined by a seam welding process.

Grau teaches a method of seam welding that utilizes a resistance roller welding process.

It would have been obvious to one skilled in the art at the time of the invention to utilize the seam welding process taught by Stowell to produce the heat exchange plates used in the reactor taught by Filippi. Such a modification would have been motivated by the teaching in Stowell that heat exchange plates can be produced using a seam process that includes seam welding. Further, it would have been obvious to one skilled in the art at the time of the invention to utilize a roller seam welding process as the seam welding process. Such a modification would have been motivated by the teaching in Grau that roller seam welding is a common method of seam welding.

### **Response to Arguments**

9. Applicant's arguments, see page 9, filed 1/21/2009, with respect to the 35 U.S.C. 112 2nd paragraph rejection of claim 5 have been fully considered and are persuasive. The rejection of claim 5 has been withdrawn. The amendment to the claim has successfully overcome the rejection.



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10. Applicant's arguments filed 1/21/2009 have been fully considered but they are not persuasive.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., a single reaction zone) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). The use of multiple reaction zones is not precluded by the instant claims.

### **Conclusion**

11. The amendment to claim 5 requiring that the gas stream comprising hydrogen chloride and molecular oxygen is fed into the gap between the heat exchange plates necessitated the new grounds of rejection.

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KEVIN M. JOHNSON whose telephone number is (571)270-3584. The examiner can normally be reached on Monday-Friday 7:30 AM to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jerry Lorengo can be reached on 571-272-1233. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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